

IEEE CAT. NO. 99CH36282

Copyright Reg. ISSN 0149-645X



(1999 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM DIGEST)

(Volume 4)

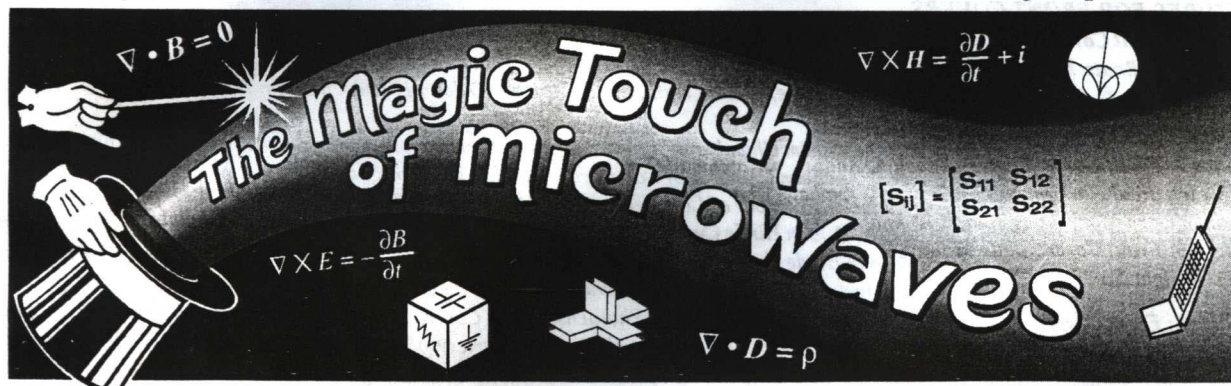
June 13 - 19, 1999
Anaheim Convention Center
Anaheim, California

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1999 IEEE MTT-S International Microwave Symposium

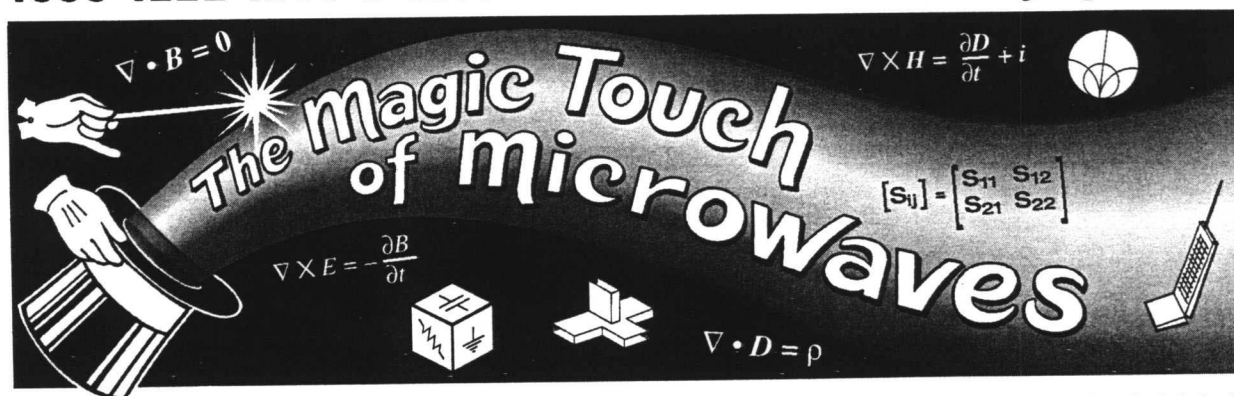


JUNE 13-19, 1999 • ANAHEIM CALIFORNIA

**1999 IEEE MTT-S
INTERNATIONAL MICROWAVE
SYMPOSIUM DIGEST**

*Technical Program Schedule
Thursday, June 17*

1999 IEEE MTT-S International Microwave Symposium

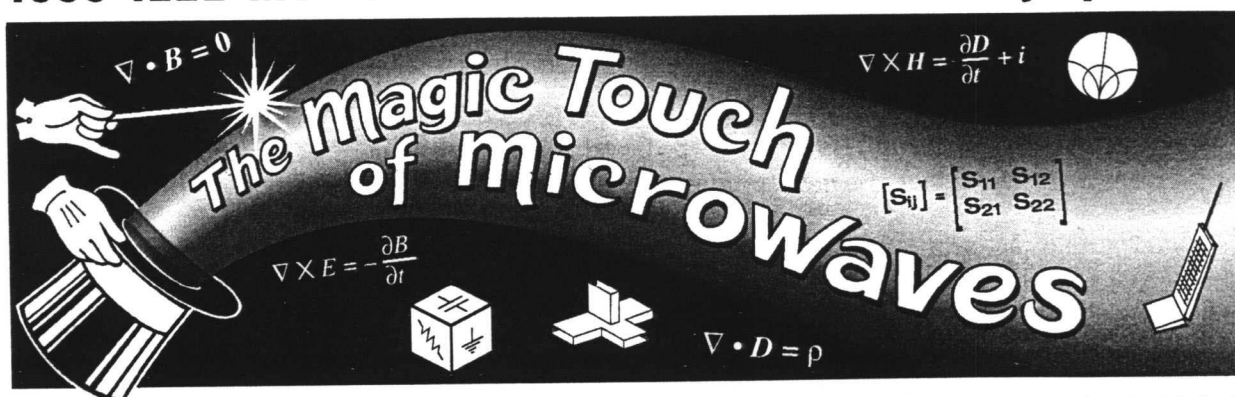


JUNE 13-19, 1999 • ANAHEIM CALIFORNIA

**1999 IEEE MTT-S
INTERNATIONAL MICROWAVE
SYMPOSIUM DIGEST**

Technical Sessions

1999 IEEE MTT-S International Microwave Symposium



JUNE 13-19, 1999 • ANAHEIM CALIFORNIA

Session TH1A

Integrated Systems for Wireless

Chair

V. Nair

Motorola, Inc.

Co-Chair

R. Marks

NIST

This session reflects the advancement in integration for subsystems for wireless applications. Power, voltage, size, weight, and cost requirements, along with demands for multimode and multiband operation, continually push this integration to higher levels.

The first three papers cover integrated technologies for power amplifiers. The first addresses the difficult issue of integrating filters on GaAs. The second provides details on a highly integrated power amplifier on AlGaAs/GaAs. The third takes a hybrid approach but nevertheless arrives with a compact power amplifier module in GaAs on a multilayer multichip module.

The fourth paper pushes integration even further, demonstrating a complete monolithic transceiver front end for 1.9 GHz wireless applications. This includes the low noise amplifier, mixer, local oscillator, buffer, and power amplifier.

The fifth paper presents a direct conversion receiver based on a resistive FET mixer. The final paper applies a SAW delay line to a signal processing problem for spread spectrum receivers.

8:00 am - 9:40 am Thursday, June 17, 1999
Room A1

1999 Microwave Symposium Technical Program Schedule

Session TH1A Integrated Systems for Wireless

8:00 am–9:40 am

Room A1

Thursday, June 17, 1999

Chair: V. Nair, Motorola, Inc.

Co-Chair: R. Marks, NIST

TH1A-1	An Integrated FBAR Filter and PHEMT Switched-AMP for Wireless Applications	1393
8:00 am	H. Morkner, R. Ruby, M. Frank and D. Figueredo	
TH1A-2	A 3.2-V Operation Single-Chip AlGaAs/GaAs HBT MMIC Power Amplifier for GSM900/1800 Dual-Band Applications	1397
8:20 am	K. Yamamoto, T. Shimura, T. Asada, T. Okuda, K. Mori, K. Choumei, S. Suzuki, T. Miura, S. Fujimoto, R. Hattori, H. Nakano, K. Hosogi, J. Otsuji, A. Inoue, K. Yajima, T. Ogata, Y. Miyazaki and M. Yamanouchi	
TH1A-3	0.1 CC 60% Efficiency Power Amplifier Multi-Chip Modules for Personal Digital Cellular Phones	1401
8:40 am	T. Saso, Y. Hasegawa, Y. Saito and Y. Kakuta	
TH1A-4	Single Chip 1.9 GHz Transceiver Frontend MMIC Including RX/TX Local Oscillators and 300 mW Power Amplifier	1405
9:00 am	J. Kucera and U. Lott	
TH1A-5	C-Band Direct Conversion Receiver Front-End Using a Resistive FET Mixer	1409
9:20 am	S. Lin, Y. Qian and T. Itoh	
TH1A-6	Tapped Dispersive SAW Delay Line Yields Powerful Signal Processing Capability in Communication Systems	1413
9:30 am	M. Brandl, A. Pohl and F. Seifert	

Session TH1B Novel Transition Structures

8:00 am–9:40 am

Room A9

Thursday, June 17, 1999

Chair: J. Owens, Auburn University

Co-Chair: K. Wu, Ecole Polytechnique de Montreal

TH1B-1	High Efficiency and Broadband Excitation of Leaky Mode in Microstrip Structures	1419
8:00 am	Y. Qian, B.C.C. Chang, T. Itoh, K.C. Chen and C.K.C. Tzuang	
TH1B-2	A Resonant Flip-Chip Design with Controllable Transition Band	1423
8:20 am	C.-L. Wang, C.-T. Hwang, R.-B. Wu and C.-H. Chen	
TH1B-3	Novel Lumped-Element Coplanar Waveguide-to-Slotline Transitions	1427
8:40 am	Y.-S. Lin and C.H. Chen	
TH1B-4	A Broadband Microstrip-to-Waveguide Transition Using Quasi-Yagi Antenna	1431
9:00 am	N. Kaneda, Y. Qian and T. Itoh	
TH1B-5	Full Band Waveguide-to-Microstrip Probe Transitions	1435
9:20 am	Y.-C. Leong and S. Weinreb	

Session TH1D

Microwave Acoustic Applications

8:00 am–9:40 am

Room AR1/AR2

Thursday, June 17, 1999

Chair: R. Kagiwada, TRW

Co-Chair: R. Weigel, University of Linz

TH1D-1 8:00 am	Investigation of Q and Power Limitations of Thin-Film Bulk Acoustic Filters by Means of Thermal Imaging K.G. Hampel, P.L. Gammel, P. Kolodner, G.E. Rittenhouse, C. Bethea, P.A. Polakos and P.M. Mankiewicz	Manuscript not available at time of printing
TH1D-2 8:20 am	Design and Performance of a SAW Ladder-Type Filter at 3.15 GHz Using SAW Mass Production Technology F. Hollerweger, A. Springer, R. Weigel, W. Ruile, R. Thomas, S. Berek and M. Guglielmi	1441
TH1D-3 8:40 am	RF-Circuit Configurations and New SAW Duplexers for Single- and Dual-Band Cellular Radios M. Hikita, N. Matsuura, N. Shibagaki and K. Sakiyama	1445
TH1D-4 9:00 am	Laser Interferometric Analysis of a ISM Band SAW Duplexer J.V. Knuuttila, P. Tikka, V.P. Plessky, T. Thorvaldsson and M.M. Salomaa	1449
TH1D-5 9:20 am	Impedance Loaded SAW-Sensors Offer a Wide Range of Measurement Opportunities R. Steindl, A. Pohl and F. Seifert	1453

Session TH1E

New Techniques in Time Domain Modeling

8:00 am–9:40 am

Room A6/A7

Thursday, June 17, 1999

Chair: W.K. Gwarek, Warsaw University of Technology
Co-Chair: W.J.R. Hoefer, University of Victoria

TH1E-1 8:00 am	Multiresolution Time Domain (MRTD) Schemes with Space-Time Haar Wavelets C.D. Sarris and L.P.B. Katehi	1459
TH1E-2 8:20 am	MRTD Applied to Complex Geometry Air-Dielectric Interfaces in 3-D Microwave Structures R.L. Robertson, E.M. Tentzeris and L.P.B. Katehi	1463
TH1E-3 8:40 am	Field Singularity Correction in 2-D Time Domain Haar Wavelet Modeling of Waveguide Components M. Fujii and W.J.R. Hoefer	1467
TH1E-4 9:00 am	Multiresolution Model of Electromagnetic Wave Propagation in Dispersive Materials I. Barba, J. Represa, M. Fujii and W.J.R. Hoefer	1471
TH1E-5 9:10 am	Applications of HAAR Wavelet Based MRTD Scheme in the Characterization of 3D Microwave Circuits K. Goverdhanam and L.P.B. Katehi	1475
TH1E-6 9:20 am	Global Finite Element Time Domain Analysis of Active Non-Linear Microwave Circuits S.-H. Chang, R. Coccioli, Y. Qian, H.-B. Lee and T. Itoh	1479

Session TH2A

Intelligent Transportation Systems

10:10 am–11:50 am

Room A1

Thursday, June 17, 1999

Chair: L. Raffaelli, ARCOM

Co-Chair: R. Dixit, TRW-Transportation Electronics

TH2A-1	A 77 GHz FM/CW Radar Frontend with a Low-Profile, Low-Loss Printed Antenna	1485
10:10 am	W. Menzel, D. Pilz and R. Leberer	
TH2A-2	Full MMIC Millimeter-Wave Front-End for a 76.5 GHz Adaptive Cruise Control Car Radar	1489
10:30 am	M. Camiade, D. Domnesque, P.F. Alleaume, A. Mallet, D. Pons and H. Dämbkes	
TH2A-3	Phase-Comparison Monopulse Radar with Switched Transmit Beams for Automotive Application	1493
10:50 am	S. Ohshima, Y. Asano, T. Harada, N. Yamada, M. Usui, H. Hayashi, T. Watanabe and H. Iizuka	
TH2A-4	Imaging RFID System at 24 GHz for Object Localization	1497
11:10 am	M.M. Kaleja, A.J. Herb, R.H. Rasshofer, G. Friedsam and E.M. Biebl	
TH2A-5	A Wideband Millimeter-Wave Front-End for Automotive Radar	1501
11:30 am	J.G.E. Mayock, C.M. Snowden, L.P. Ligthart and P.J.F. Swart	

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Session TH2B

Micromachined Components

10:10 am–11:50 am

Room A9

Thursday, June 17, 1999

Chair: L. Katehi, University of Michigan

Co-Chair: T. Weller, University of South Florida

TH2B-1	Design and Modeling of RF MEMS Tunable Capacitors Using Electro-Thermal Actuators	1507
10:10 am	Z. Feng, W. Zhang, B. Su, K.F. Harsh, K.C. Gupta, V. Bright and Y.C. Lee	
TH2B-2	30 GHz Tuned MEMS Switches	1511
10:30 am	J.B. Muldavin and G.M. Rebeiz	
TH2B-3	MEMS Reconfigurable Vee Antenna	1515
10:50 am	J.-C. Chiao, Y. Fu, I.M. Chio, M. DeLisio and L.-Y. Lin	
TH2B-4	Design and Realization of High Q Millimeter-Wave Structures Through Micromachining Techniques	1519
11:10 am	B. Guillon, D. Cros, P. Pons, K. Grenier, T. Parra, J.L. Cazaux, J.C. Lalaurie, J. Graffeuil and R. Plana	
TH2B-5	A Micromachined RF Microswitch Applicable to Phased-Array Antennas	1923
11:20 am	K. Suzuki, S. Chen, T. Marumoto, Y. Ara and R. Iwata	
TH2B-6	High-Performance Three-Dimensional On-Chip Inductors Fabricated by Novel Micromachining Technology for RF MMIC	1523
11:30 am	J.-B. Yoon, C.-H. Han, E. Yoon and C.-K. Kim	

Session TH2C

(Focused Session)

Microwave Applications of Photonic Bandgap Materials

10:10 am–11:50 am

Room A10

Thursday, June 17, 1999

Chair: D. Jaeger, Gerhard-Mercator University

TH2C-1	High-Impedance Electromagnetic Ground Planes	1529
10:10 am	D. Sievenpiper, L. Zhang and E. Yablonovitch	
TH2C-2	Computational Studies of Photonic Crystals	Manuscript not available at time of printing
10:30 am	S. Fan	
TH2C-3	Planar Periodic Structures for Microwave and Millimeter Wave Circuit Applications	1533
10:50 am	Y. Qian and T. Itoh	
TH2C-4	Fundamental Artificial Periodic Substrate Effects on Printed Circuit Antennas	1537
11:10 am	H.Y.D. Yang, J. Wang and R. Kim	
TH2C-5	Laminated Photonic Band Structures with High Conductivity and High Transparency	893
11:30 am	M.J. Bloemer, M. Scalora and J.P. Dowling	

Session TH2D

Superconducting Components and Subsystems

10:10 am–11:50 am

Room AR1/AR2

Thursday, June 17, 1999

Chair: J.M. Pond, Naval Research Lab

Co-Chair: M. Lancaster, University of Birmingham

TH2D-1	High-Temperature Superconductive Butler Matrix Beamformer for Satellite Applications	1543
10:10 am	S.F. Peik, B. Jolley and R.R. Mansour	
TH2D-2	Efficient Computer Design of Compact Planar Band-Pass Filters Using Electrically Short Multiple Coupled Lines	1547
10:30 am	G.L. Hey-Shipton	
TH2D-3	HTS Microstrip Filters with Multiple Symmetric and Asymmetric Prescribed Transmission Zeros	1551
10:50 am	J.-F. Liang, C.-F. Shih, Q. Huang, D. Zhang and G.-C. Liang	
TH2D-4	Design and Construction of High Performance HTS Pseudo-Elliptic Band-Stop Filters	1555
11:10 am	E.R. Soares	
TH2D-5	Cross-Coupled HTS Microstrip Open-Loop Resonator Filter on LAO Substrate	1559
11:20 am	J.-S. Hong, M.J. Lancaster and J.-C. Mage	
TH2D-6	Novel Approach for Narrowband Superconducting Filters	1563
11:30 am	M. Reppel and H. Chaloupka	

Session TH2E

Advances in Time Domain EM Field Analysis

10:10 am–11:50 am

Room A6/A7

Thursday, June 17, 1999

Chair: L. Roselli, University of Perugia

Co-Chair: P. Russer, Munich University of Technology

TH2E-1	Time Domain Modeling of E.M. Coupling Between Microwave Circuit Structures	1569
10:10 am	S. Lindenmeier, L. Pierantoni and P. Russer	
TH2E-2	FDTD Accuracy Improvement by Incorporation of 3D Edge Singularities	1573
10:30 am	N.-H. Huynh and W. Heinrich	
TH2E-3	Full-Wave Analysis of X-Band MMIC Pre-Matched Power Cell	1577
10:50 am	S.-H. Chang, R. Coccioli, B. Housmand and T. Itoh	
TH2E-4	Reduced FDTD Formulation (R-FDTD) for the Analysis of 30 GHz Dielectric Resonator Coupled to a Microstrip Line	1581
11:00 am	G. Kondylis, F. De Flaviis, G. Pottier, M. Sironen and T. Itoh	
TH2E-5	Numerical Parasitic Reactances at the Interface Between FDTD Mesh and Lumped Elements	1585
11:10 am	L. Borzetta, F. Alimenti, P. Ciampolini, P. Mezzanotte, L. Roselli and R. Sorrentino	
TH2E-6	A Conducting Sheet Model for Efficient Wide Band FDTD Analysis of Planar Waveguides and Circuits	1589
11:30 am	A. Lauer and I. Wolff	

Session TH3A

Sensor Applications

1:20 pm–3:00 pm

Room A1

Thursday, June 17, 1999

Chair: R. Henning, University of South Florida

Co-Chair: B.E. Spielman, Washington University

TH3A-1	An Active Tagging System Using Circular Polarization Modulation	1595
1:20 pm	M. Kossel, H. Benedickter and W. Baechtold	
TH3A-2	A Microwave Position Sensor with Sub-Millimeter Accuracy	1599
1:40 pm	A. Stelzer, C.G. Diskus and H.W. Thim	
TH3A-3	A Microwave System for Moisture Monitoring in Wet Powders for Industrial Applications	1603
2:00 pm	G. Bianchi, M. Dionigi, D. Fioretto and R. Sorrentino	
TH3A-4	Modular Design of SAR Electronics	1607
2:20 pm	F.A. Petz, J. Rosello-Guasch, C. Mavrocordatos and Ch.V. Narasimha Rao	
TH3A-5	Near-Field Synthetic Aperture Interferometric Microwave Radiometry for Remote Sensing of Mines	1611
2:40 pm	R.J. Tan and R. Bender	

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Session TH3B

Passive Circuit Elements and Components

1:20 pm–3:00 pm

Room A9

Thursday, June 17, 1999

Chair: J. Taub, Consultant

TH3B-1	A Retrospective on the 1999 Microwave Pioneer Award	1617
1:20 pm	R.L. Eisenhart and P.J. Khan	
TH3B-2	Novel High-Q Bondwire Inductors for RF and Microwave Monolithic Integrated Circuits	1621
1:50 pm	S.-J. Kim, Y.-G. Lee, S.-K. Yun and H.-Y. Lee	
TH3B-3	A Study on Substrate Effects of Silicon-Based RF Passive Components	1625
2:00 pm	C.P. Yue and S.S. Wong	
TH3B-4	One-Dimensional Photonic Bandgap Resonators and Varactor Tuned Resonators	1629
2:20 pm	T.-Y. Yun and K. Chang	

Session TH3C

Microwave Measurement Techniques

1:20 pm–3:00 pm

Room A10

Thursday, June 17, 1999

Chair: J. Barr, Hewlett-Packard

Co-Chair: B. Szendrenyi, Maury Microwave Corp.

TH3C-1	Active Probes for 2-Port Network Analysis Within 70–230 GHz	1635
1:20 pm	O. Wohlgenuth, M.J.W. Rodwell, R. Reuter, J. Braunstein and M. Schlechtweg	
TH3C-2	Determining Two-Port S-Parameters from a One-Port Measurement Using a Novel Impedance-State Test Chip	1639
1:40 pm	V.M. Hietala	
TH3C-3	On-Wafer Calibration Using Space-Conservative (SOLT) Standards	1643
2:00 pm	M. Imparato, T. Weller and L. Dunleavy	
TH3C-4	A New Structure for a Six-Port Reflectometer Using a Silicon MOSFET for Power Measurement	1647
2:10 pm	M. Ratni, B. Huyart, E. Bergeault and L. Jallet	
TH3C-5	A New Dynamic Load-Line Measurement Method with EOS and Load-Pull System for Power FET Design	1651
2:20 pm	H. Takahashi and M. Kanamori	
TH3C-6	A Controllable Phase Coherent Modulated RF Signal for the Use with Microwave Network Analyzer Measurements	1655
2:30 pm	P. Vael and Y. Rolain	
TH3C-7	Validation of a Microwave Multitone Signal with Known Phase	1659
2:40 pm	A. Barel and Y. Rolain	

Session TH3D

Frequency Domain Numerical Techniques I

1:20 pm–3:00 pm

Room AR1/AR2

Thursday, June 17, 1999

Chair: J. Bornemann, University of Victoria

Co-Chair: A. Beyer, Duisburg University

TH3D-1	Large-Domain MOM Solution of Complex Electromagnetic Problems	1665
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TH3D-2	The Frequency-Domain TLM Method with Absorbing Boundary Conditions	1669
1:40 pm	D. Pasalic, R. Vahldieck and J. Hesselbarth	
TH3D-3	Fast Hybrid Integral Equation-Neural Network Method for the Modeling of Multiconductor Transmission Lines	1673
2:00 pm	P.-M. Piel, J. Griffith, T.-T. Lam and G.W. Pan	
TH3D-4	Full-Wave Analysis of Radiation from a Microstrip Amplifier	1677
2:20 pm	T.-S. Horng and S.-M. Wu	
TH3D-5	Electrodynamic Coplanar/Slotline Structure Analysis with 3-D Components Based on a Surface/Volume Integral Equation Approach	1681
2:40 pm	T. Vaupel and V. Hansen	
TH3D-6	Modeling of the Millimeter-Wave Behavior of MEMS Capacitive Switches	1685
2:50 pm	L. Vietzorreck	

Session TH4A

Frequency Domain Numerical Techniques II

3:30 pm–5:10 pm

Room A1

Thursday, June 17, 1999

Chair: L. Williams, ANSOFT Corp.

TH4A-1	GSM/Moment-Method CAD of Waffle-Iron-Filters with Round Teeth	1691
3:30 pm	R. Bunger and F. Arndt	
TH4A-2	Edge-Conditioned Vector Basis Functions for the Analysis and Optimization of Rectangular Waveguide Dual-Mode Filters	1695
3:50 pm	J. Bornemann, U. Rosenberg, S. Amari and R. Vahldieck	
TH4A-3	Generalized Admittance Matrix of Arbitrary E-Plane Waveguide Junctions by the BI-RME Method	1699
4:10 pm	P. Arcioni, M. Bressan and G. Conciauro	
TH4A-4	An Efficient Finite-Element Method for the Analysis of Photonic Band-Gap Materials	1703
4:30 pm	L. Zhang, N.G. Alexopoulos, D. Sievenpiper and E. Yablonovitch	
TH4A-5	Efficient MOM-Based Generalized Scattering Matrix Method for the Integrated Circuit and Multilayered Structures in Waveguide	1707
4:40 pm	A.I. Khalil, A.B. Yakovlev and M.B. Steer	
TH4A-6	A Multi-Resolution MoM Analysis of Multiport Structures Using Matched Terminations	1711
5:00 pm	R. Loison, R. Gillard, J. Citerne and G. Piton	

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Session TH4B

Couplers and Baluns

3:30 pm–5:10 pm

Room A9

Thursday, June 17, 1999

Chair: E.J. Denlinger, Sarnoff Corp.

TH4B-1	Broadband Coplanar Couplers in Multilayer Thin Film MCM-D Technology	1717
3:30 pm	P. Pieters, S. Brebels, W. De Raedt and E. Beyne	
TH4B-2	Compact Multi-Level Folded Coupled Line RF Couplers	1721
3:50 pm	R.K. Settaluri, A. Weisshaar, C. Lim and V.K. Tripathi	
TH4B-3	A Design of the Novel Varactor Tuned Directional Coupler	1725
4:00 pm	C.-S. Kim, C.-S. Yoon, J.-S. Park, D. Ahn, J.-B. Lim and S.-I. Yang	
TH4B-4	Full-Wave Optimum Design of Millimeter-Wave Rectangular Waveguide Narrow-Wall Branch Couplers	1729
4:10 pm	T. Shen, Y. Rong and K.A. Zaki	
TH4B-5	Low-Loss, Planar Monolithic Baluns for K/Ka-Band Applications	1733
4:30 pm	J. Schellenberg and H. Do-Ky	
TH4B-6	A Parallel Connected Marchand Balun Using Spiral Shaped Equal Length Coupled Lines	1737
4:50 pm	M. Shimozawa, K. Itoh, Y. Sasaki, H. Kawano, Y. Isota and O. Ishida	

Session TH4C

(Joint with ARFTG)

Automated Characterization Techniques

3:30 pm–5:10 pm

Room A10

Thursday, June 17, 1999

Chair: K. Wong, Hewlett-Packard

TH4C-1	On-Wafer Load Pull Characterization of W-Band InP HEMT Unit Cells for CPW MMIC Medium Power Amplifiers	1743
3:30 pm	D.W. Baker, R.S. Robertson, R.T. Kihm, M. Matloubian, M. Yu and R. Bowen	
TH4C-2	CAD Oriented Design Methods of Frequency Multipliers. Application to a Millimeter-Wave MMIC PHEMT Tripler and a Microwave HBT Doubler	1747
3:50 pm	B. Thibaud, D. Barataud, M. Campovecchio, J.M. Nebus, S. Tranchant, P. Quentin and D. Floriot	
TH4C-3	Wideband Propagation Measurements and Doppler Analysis for the 60 GHz Indoor Channel	1751
4:10 pm	S. Guillouard, G. El Zein and J. Citerne	
TH4C-4	A New Open-Resonator Technique at 60 GHz for Permittivity and Loss-Tangent Measurement of Low-Loss Materials	1755
4:20 pm	M.N. Afsar, H. Ding and K. Tourshan	
TH4C-5	Microwave Characterization of Integrated and Multilayered Directional Couplers for Wireless Communication Applications	1759
4:40 pm	F. Fortin, B. Flechet, F. Grandjean, G. Angemeux and S.A. Radiall	
TH4C-6	Automated Phase Noise Measurement of Ku-Band MMIC VCO On-Wafer	1763
5:00 pm	J.M. Yang, D.C. Yang, P.G. Cheng and J.M. Dickson	

Session THF1

Interactive Forum

Technologies at the Edge of the Microwave Frequency Range

2:30 pm–5:00 pm

Convention Center Arena

Thursday, June 17, 1999

Chair: K. Agarwal, Raytheon Systems Co.
Co-Chair: M. Matloubian, HRL Laboratories

THF1-1	An Efficient SOM for Front-End UHF Electronics	1769
2:30 pm	M. Ghanevati, A.V. Thangavelu, J.H. Lee, R. Gutierrez and A.S. Daryoush	
THF1-2	True RMS Power Detection with High Dynamic Range	1773
2:30 pm	G. Klahn	
THF1-3	Theoretical Analysis of Wurtzite and Zincblende Phase GaN Avalanche Transit Time Device in Millimeter-Wave Frequencies	1777
2:30 pm	C.C. Meng, G.R. Liao and J.W. Chen	
THF1-4	A 90GHz-Band Monoblock Type Waveguide Orthomode Transducer	1781
2:30 pm	N. Yoneda, M. Miyazaki and T. Noguchi	
THF1-5	Nonradiative Dielectric Waveguide Using Cordierite Ceramics	1785
2:30 pm	N. Hiramatsu, T. Kishino, T. Okamura, H. Kii and D.A. Sagala	
THF1-6	NbN Hot Electron Bolometric Mixers—A New Technology for Low Noise THz Receivers	1789
2:30 pm	E. Gerecht, C.F. Musante, Y. Zhuang, K.S. Yngvesson, T. Goyette, J. Dickinson, J. Waldman, P.A. Yagoubov, G.N. Gol'tsman, B.M. Voronov and E.M. Gershenzon	
THF1-7	A Novel Method of Pulse Power Amplification Using a CW Injection Locked Oscillator Pair	1793
2:30 pm	M. Simonutti	
THF1-8	A Compact High Performance W-Band FMCW Radar Front-End Based on MMIC Technology	1797
2:30 pm	J.R. Lamberg, M.J. Gawronski, J.J. Geddes, W.R. Carlyon, R.A. Hart, G.S. Dow, E.W. Holmes and M.Y. Huang	
THF1-9	Light Dependence of Silicon FGCPW Transmission Lines	1801
2:30 pm	S.J. Spiegel and A. Madjar	
THF1-10	Characteristics of Optically Controlled Oscillator Using InP HEMT with Novel Structure	1805
2:30 pm	H. Shiomi, S. Kawasaki, K. Matsugatani and T. Taguchi	
THF1-11	Very Low Phase Noise Optical Links: Experiments and Theory	1809
2:30 pm	M.-B. Bibey, F. Deborgies, M. Krakowski and D. Mongardien	

Session THF2

Interactive Forum

Biological Effects

2:30 pm–5:00 pm

Convention Center Arena

Thursday, June 17, 1999

Chair: P. Yu, University of California-San Diego

THF2-1	Reconstructing Permittivity Profiles Using an Improved Renormalization Technique	1815
2:30 pm	M.J. Akhtar and A.S. Omar	
THF2-2	Two Dimensional Dielectric Profile Reconstruction Based on Spectral Domain Moment Method and Non-Linear Optimization	1819
2:30 pm	T.A. Maniatis, K.S. Nikita and N.K. Uzunoglu	

TH	F1
TH	F2
TH	F3
TH	F4

Session THF3

Interactive Forum

Active and Passive Phased Array Systems

2:30 pm–5:00 pm **Convention Center Arena** **Thursday, June 17, 1999**
Chair: R. Kaul, Army Research Lab

THF3-1	Quasi-Optical Discrete Beam Steering Grids	1825
2:30 pm	J. Mazotta, M. DeLisio and J.-C. Chiao	
THF3-2	Two Ka-Band Quasi-Optical Amplifier Arrays	1829
2:30 pm	M. Forman, T. Marshall and Z. Popović	
THF3-3	A 65 GHz Holographic Power Combiner	1833
2:30 pm	M. Höft, B. Schumann, R. Judaschke and M. Shahabadi	

Session THF4

Interactive Forum

RF Wireless and Sensors

2:30 pm–5:00 pm **Convention Center Arena** **Thursday, June 17, 1999**
Chair: V. Nair, Motorola Co.
Co-Chair: P. Heide, Siemens, AG

THF4-1	Novel Adaptive Linearization for Digitally Modulated Multi-Carriers Power Amplifier Using Pre-Distorter Cum Cross-Correlator (PDCC)	1839
2:30 pm	Y.W.M. Chia, Y. Zou and C.C. Ko	
THF4-2	WCDMA Power Amplifier Requirements and Efficiency Optimization Criteria	1843
2:30 pm	H. Lilja and H. Mattila	
THF4-3	A New SAW Based OFDM Receiver Concept	1847
2:30 pm	M. Huemer, L. Reindl, C.C.W. Ruppel, A. Springer and R. Weigel	
THF4-4	FN-Modulation Loop Architecture for Fully Integrated 1 MB/S GFSK Transmitter	1851
2:30 pm	G. Märzinger, A. Springer, R. Weigel, S. Herzinger and J. Fenk	
THF4-5	A Wireless Data Collection System for Monitoring and Control of City Lifelines	1855
2:30 pm	S. Mizushina, M. Sugiura, S. Ito, M. Atsumi, A. Adachi and T. Watanabe	
THF4-6	Evanescent Microwave Probes Using Coplanar Waveguide and Stripline for Super-Resolution Imaging of Materials	1859
2:30 pm	G.E. Ponchak, D. Akinwande, R. Ciocan, S.R. LeClair and M. Tabib-Azar	
THF4-7	Microstrip Resonator Technique for Non-Destructive Moisture/Permittivity Measurement	1863
2:30 pm	K.K. Joshi and R.D. Pollard	
THF4-8	10 and 2.45 GHz Short Baseline Interferometers for Positioning Systems	1867
2:30 pm	A. Benlarbi-Delaï, J.C. Cousin, R. Ringot, A. Mamouni and Y. Leroy	
THF4-9	A Monostatic Radio-Acoustic Sounding System	1871
2:30 pm	M. Weiss and R. Knoechel	

Session THF5

Interactive Forum

RF Component Measurement and Characterization Techniques

2:30 pm–5:00 pm

Convention Center Arena

Thursday, June 17, 1999

Chair: Z. Bardai, Raytheon Systems Co.

THF5-1 2:30 pm	Multi-Port Scattering Matrix Measurement Using a Reduced-Port Network Analyzer H.-C. Lu and T.-H. Chu	1877
THF5-2 2:30 pm	Comparison of Methods for Adapter Characterization J. Randa, W. Wiatr and R.L. Billinger	1881
THF5-3 2:30 pm	Millimeter Wave Measurements of Temperature Dependence of Complex Permittivity of Dielectric Plates by a Cavity Resonance Method Y. Kobayashi and T. Shimizu	1885
THF5-4 2:30 pm	Effects of Moisture Desorption on Phase and Gain of RF Filters Made with PTFE/Ceramic Laminate Circuit Boards R.J. Fern and L.O. Duffy	Manuscript not available at time of printing
THF5-5 2:30 pm	GaAs FET Characterization in a Quasi-Monolithic Si Environment E. Wasige, G. Kompa, F. van Raay, W. Scholz, I.W. Rangelow, R. Kassing, S. Bertram and P. Hudek	1889
THF5-6 2:30 pm	A Design of the Ceramic Multilayer Chip Balun D.-W. Lew, J.-S. Park, D. Ahn, N.-K. Kang, I.-S. Park, W. Lim and C.-S. Yoo	1893
THF5-7 2:30 pm	Passive Integration on Si for RF Circuits in Wireless Applications N.J. Pulsford, J.T.M. van Beek, M.H.W.M. van Delden, A. Boogaard and R.F. Milsom	1897
THF5-8 2:30 pm	Material Parameter Characterization of Multilayer LTCC and Implementation of High Q Resonators H. Liang, A. Sutono, J. Laskar and W.R. Smith	1901
THF5-9 2:30 pm	Proposed Design Solutions for Low-Cost Flip-Chip Membrane Devices for Millimeterwave Applications S. Perrot, Ch. Person, L. Carré, H. Lattard and M. Ney	1905
THF5-10 2:30 pm	Ni-Au Surface Finish Effects on RF Performance D. Staiculescu, J. Laskar, J. Mendelsohn, E. Sweetman, D. Rudy and I. Artaki	1909
	Late Papers	1913

High Efficiency and Broadband Excitation of Leaky Mode in Microstrip Structures

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Abstract - This paper reports a novel technique for high efficiency and broadband excitation of the first higher-order leaky mode in microstrips. A uniplanar microstrip-to-CPS transition is employed to launch the odd leaky mode, and the mode purity is enhanced by suppressing the even fundamental mode using an optimized mode suppressor. An X-band prototype demonstrates excellent mode conversion efficiency as predicted by simulations. A record bandwidth of 20.2 % is achieved for a microstrip leaky-wave source based on this newly proposed structure.

I. INTRODUCTION

Leakage from higher-order modes in microstrips and other planar structures has attracted much attention since the pioneering work by Oliner [1]. Dispersion characteristics of the leaky modes have been analyzed with various techniques such as the spectral-domain moment method [2]. Leaky-wave microstrip antenna had been successfully demonstrated even before the nature of complex mode in the microstrip was fully characterized [3]. Recent efforts include active integrated leaky-wave antennas [4], which show great potential as

applications move towards higher microwave and MMW-wave frequencies.

One major concern with microstrip-based leaky wave structures is the simultaneous excitation of the even fundamental (quasi-TEM) mode in addition to the desired leaky mode. A slotline-fed structure should ideally excite a pure odd (leaky) mode, but the radiation efficiency was found to be inferior to a CPS-fed approach [5]. The CPS feeding, however, requires either a microstrip or CPW-based transition to realize the 180° phase difference. Because of the frequency dependence of these planar-type transitions, a substantial portion of even mode will be excited, especially when a relatively broadband design is required.

This paper reports our recent effort in developing broadband leaky mode launching structure for microstrip antenna applications. By using a uniplanar microstrip-to-CPS transition in combination with a mode suppressor consisting of optimized periodic slots, excellent mode conversion efficiency has been obtained. An X-band prototype was fabricated and tested, which gave satisfactory results. In a simple demonstration, a record bandwidth of 20.2 % (VSWR<2) was achieved for a microstrip leaky-wave source based on this new leaky mode launcher.

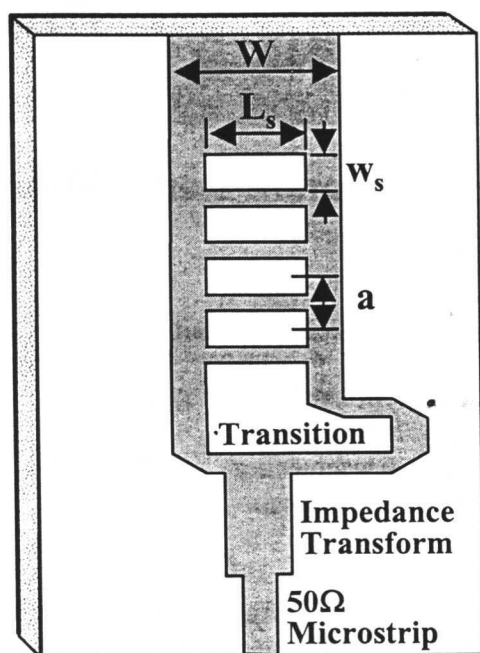


Fig. 1. Proposed microstrip leaky mode launcher with a broadband microstrip-to-CPS transition and transverse slots for even mode suppression.

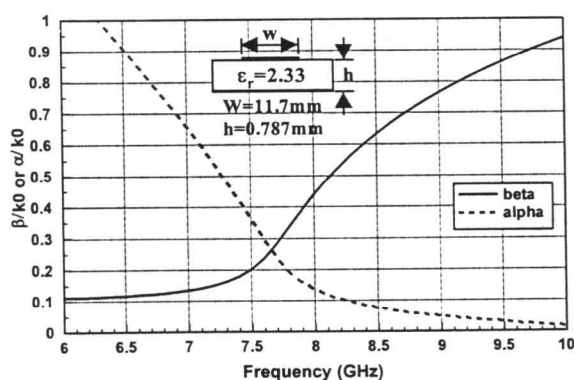


Fig. 2. Dispersion Characteristics of the first higher-order leaky mode in a 11.7 mm wide microstrip on Duroid substrate with $\epsilon_r=2.33$ and thickness of 0.787mm.

II. DESCRIPTION OF STRUCTURE AND SIMULATION RESULTS

Fig. 1 shows the schematic of the proposed structure. A uniplanar microstrip-to-CPS transition is used to convert the quasi-TEM

mode from the 50 Ω feeding line into an odd mode which feeds the two edges of the leaky microstrip of width W . The transition has inherently very broad bandwidth, as we have demonstrated previously [6]. For a leaky microstrip with dimensions shown in Fig. 2, the calculated attenuation constant (α) indicates that it can serve as a proper leaky wave source in the frequency range of approximately 8 to 10 GHz. Accordingly, the two arms following the T-junction of the transition in Fig. 1 are designed to have 180° phase difference at around 9 GHz.

Meanwhile, in order to suppress the possible excitation of the fundamental even mode and enhance the purity of the desired leaky mode, a periodic structure of transverse slots cut in the microstrip, as proposed originally by Menzel in [3], is employed.

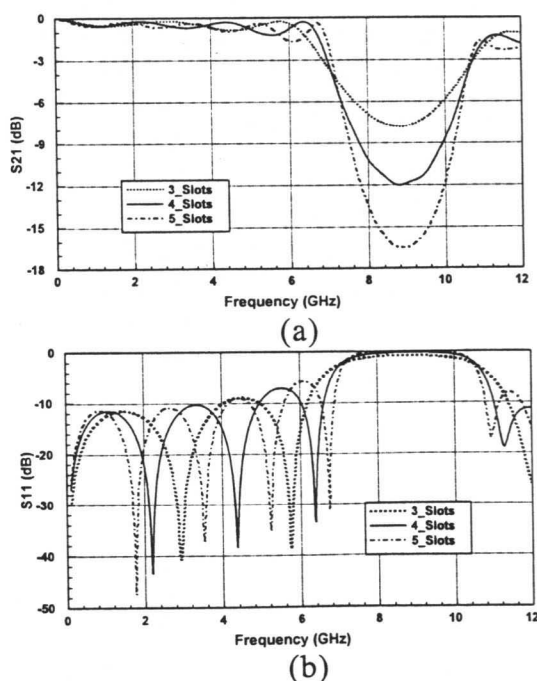


Fig. 3. FDTD simulation results for transmission (S21) and reflection (S11) of the fundamental mode in the microstrip with optimized transverse slots.